



Missouri Department of Natural Resources

## Total Maximum Daily Load Information Sheet

### Chat Creek (formerly Douger Branch<sup>1</sup>)

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#### Water Body Segment at a Glance:

<b>County:</b>	Lawrence
<b>Nearby Cities:</b>	Aurora
<b>Length of impaired segment:</b>	4.5 miles <sup>2</sup>
<b>Length of impairment within segment:</b>	1.0 mile
<b>Pollutants 1, 2:</b>	Lead and Zinc (S) <sup>3</sup>
<b>Source:</b>	Abandoned mine tailings
<b>Pollutant 3:</b>	Cadmium (W)
<b>Source:</b>	Baldwin Park mine
<b>Water body ID:</b>	3168



State map showing location of watershed

**Scheduled for TMDL development:** 2012

**Prior TMDL:** A TMDL for zinc (W) was approved in 2006

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#### Description of the Problem

##### Designated beneficial uses of Chat Creek

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)
- Whole Body Contact Recreation

##### Use that is impaired

- Protection of Warm Water Aquatic Life

##### Standards that apply

- Missouri Water Quality Standards found in 10 CSR 20-7.031(4)(B)1 state:

Water contaminants shall not cause the criteria in Tables A and B to be exceeded.

Concentrations of these substances in bottom sediments or waters shall not harm benthic

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<sup>1</sup> Douger Branch's name was corrected to Chat Creek in the revised Missouri's WQS effective 10/30/09.

<sup>2</sup> Only the upper 1/3 or so of the former Douger Branch is named Chat Creek on USGS maps, so the creek was split in two. The upper 2.1 miles retained the WBID (3168) and was correctly named Chat Creek. The lower portion retained the name Douger Branch and was given a new WBID (3810) and a new length (3.1 miles).

<sup>3</sup> (W) = in water as dissolved metal; (S) = in sediment/soil.

organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.

Table A of the Water Quality Standards contains dissolved metals criteria for the protection of aquatic life designated use. These criteria are hardness dependent and limits for cadmium are calculated from the formulas shown below:

#### Dissolved Cadmium

Acute =  $e^{(1.0166 \cdot \ln(\text{hardness}) - 3.062490) \cdot (1.136672 - (\ln(\text{hardness}) \cdot 0.041838))}$  = µg/L, or micrograms per liter

Chronic =  $e^{(0.7409 \cdot \ln(\text{hardness}) - 4.719948) \cdot (1.101672 - (\ln(\text{hardness}) \cdot 0.041838))}$  = µg/L

- Missouri has no numeric criteria for metals in sediment. Likewise, the U.S. Environmental Protection Agency has not yet established federal guidelines for toxic chemicals in stream or lake sediments. In lieu of such criteria, Probable Effect Concentrations, or PECs, suggested by McDonald, et. al<sup>4</sup>, are used. PECs are the concentrations at which some toxic effect on aquatic life is likely

#### **Background information and water quality data**

##### History:

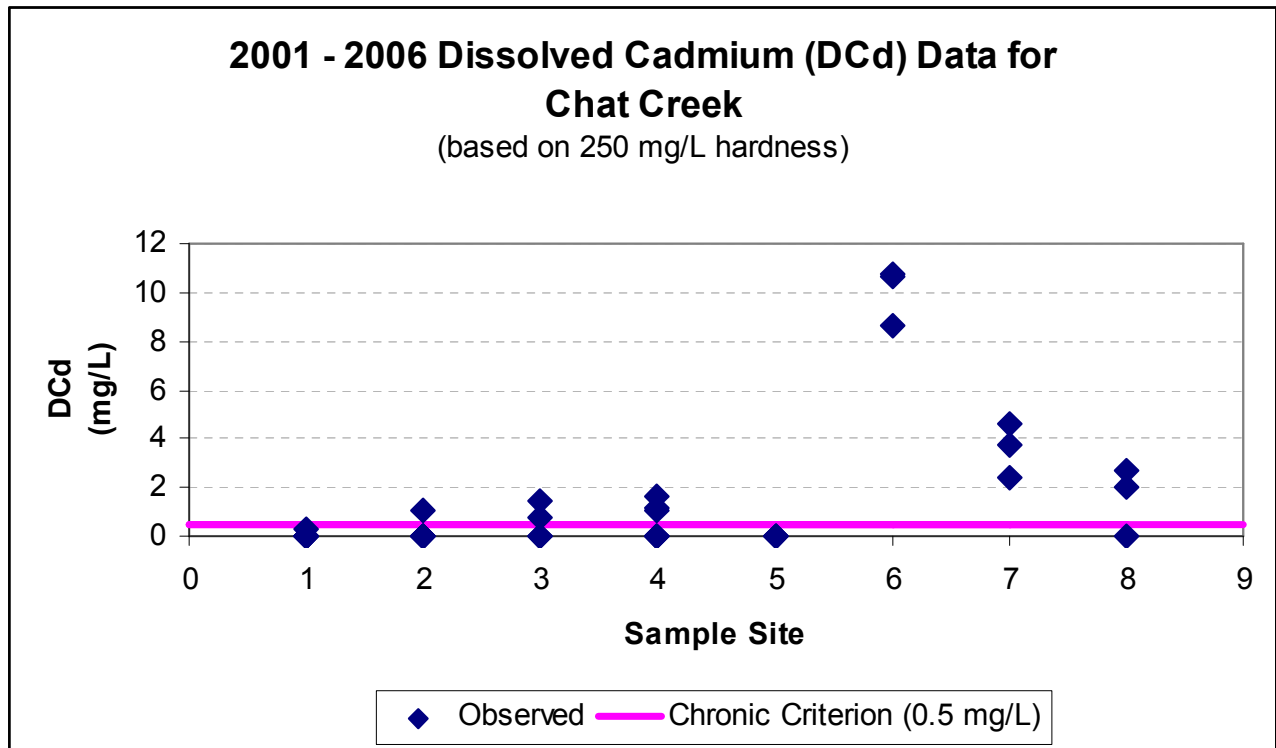
Past underground mining of lead and zinc occurred in the Baldwin Park area just northeast of the city of Aurora in the upper Chat Creek watershed. Chat Creek has elevated levels of zinc in that area. After mining ceased in 1955, these underground mines filled with groundwater and zinc minerals in the walls of the mines dissolved into this groundwater. Zinc is an essential nutrient to aquatic and terrestrial organisms, but in excess can be highly toxic and has the tendency to bioaccumulate (build up in organisms) in the environment. Zinc-contaminated groundwater from these mines is resurfacing in a small tributary of Chat Creek (locally called Baldwin Park Tributary) along the railroad tracks about 0.5 miles east of town. Zinc levels in this tributary are especially high. The U.S. Environmental Protection Agency approved a TMDL for dissolved zinc in Chat Creek (formerly referred to as Douger Branch) August 29, 2006.

##### Dissolved cadmium:

Elevated cadmium has also been detected in Chat Creek (Figure 1) and was added to the 303(d) List in 2008. Cadmium is a minor component in most lead ores and therefore is a by-product of lead production. It is known to be highly toxic and carcinogenic.

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<sup>4</sup> *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*, D. MacDonald, et al., 2000. USGS



**Figure 1**

Lead and zinc in sediment:

A water body is considered impaired by metals in sediment when the levels exceed the PEC by 150 percent (see standards that apply, above). The department collected sediment data from 2003-2007 (Figures 2 and 3). The mean, or average, level of lead in the sediments for Chat Creek is 235 mg/kg, or milligrams per kilogram, which is the same as parts per million. This is 184 percent the PEC, the concentration at which some toxic effect on aquatic life is likely. The mean level of zinc in the sediments for Chat Creek is 1920 mg/kg. This is over 400 percent of the PEC. Based on the location of sediment sampling sites in relation to known or suspected sources of metals, one mile of the creek was judged to be impaired by zinc and lead in the sediment.

Contamination of stream sediments has led to the contamination of fish and other aquatic life. Toxicity of zinc is discussed above. For lead, it is known that lead bioaccumulates in the bodies of aquatic creatures, which has been documented in the levels of lead in fish in Big River, another water body in Missouri that is contaminated with mine tailings. New studies done in the Big River show that the lead and other metals in these tailings are toxic to mussels, crayfish and other small invertebrates that inhabit the bottom of the river. These conclusions may be transferrable to Chat Creek.

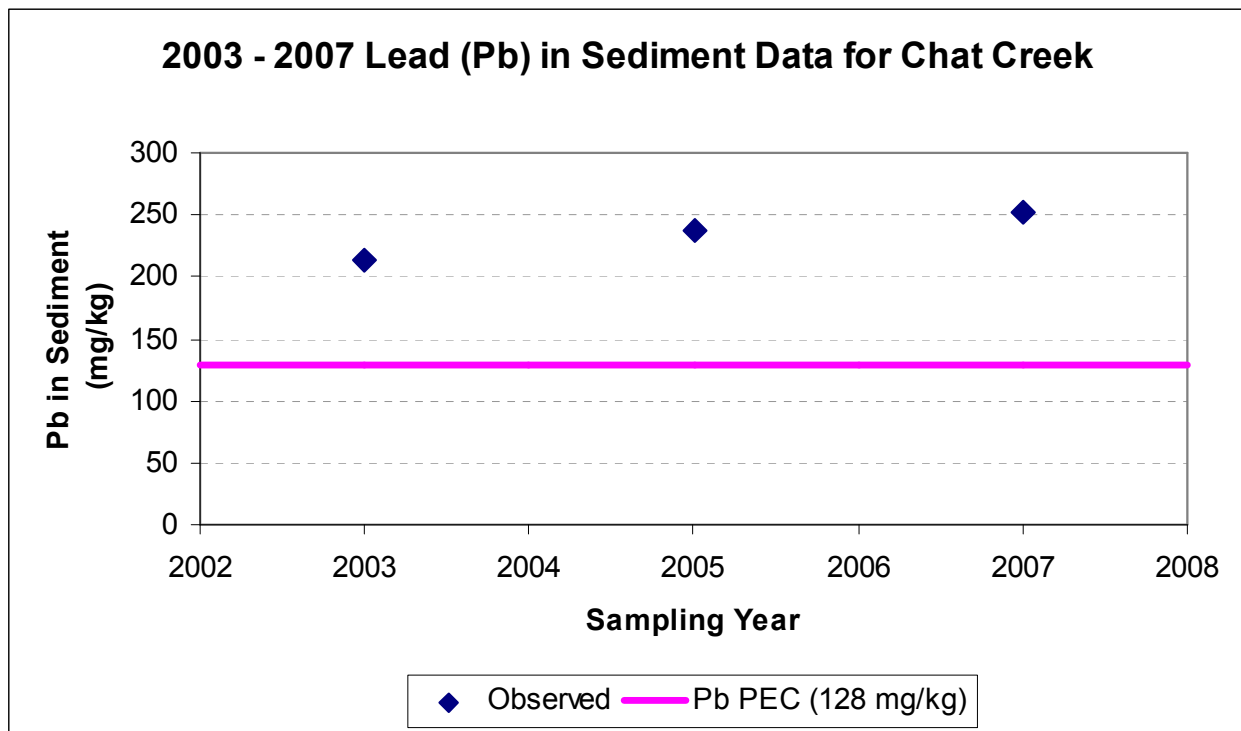


Figure 2

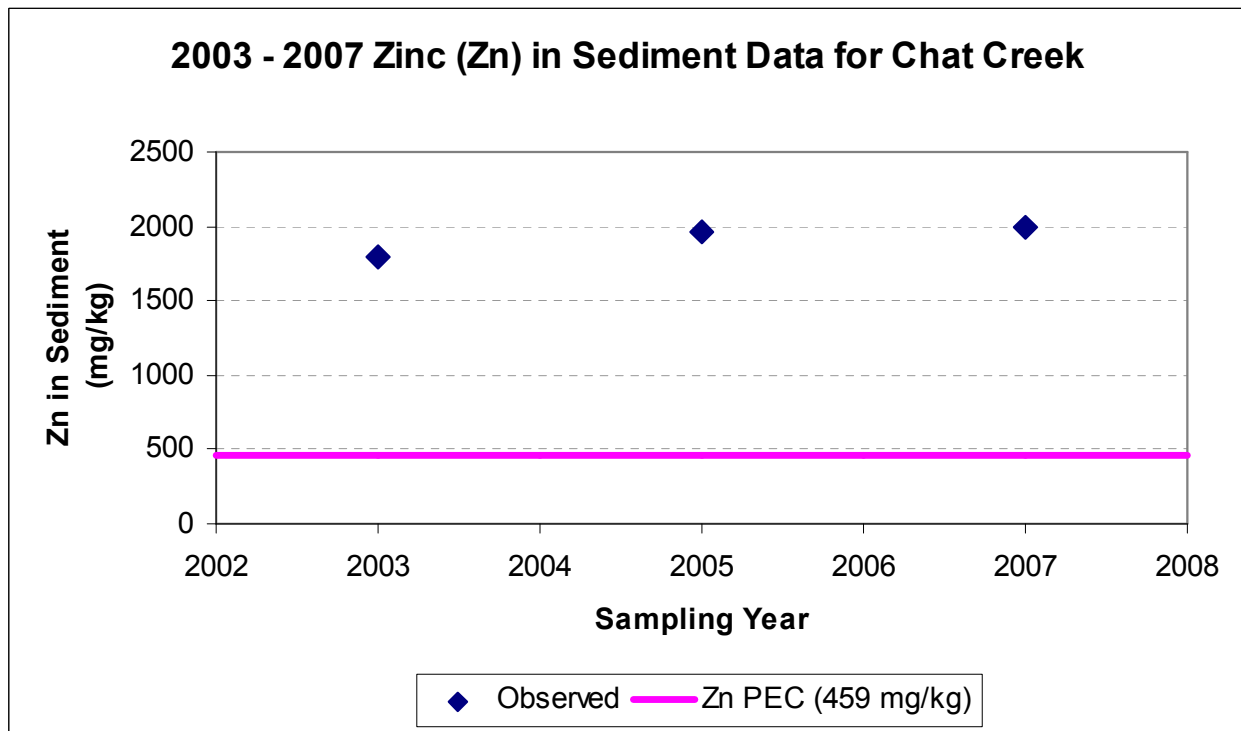


Figure 3

### Remediation:

The U.S. Environmental Protection Agency, or EPA, Region VII, first investigated Baldwin Park in October 1979. The investigation was initiated because a portion of Baldwin Park was used as a municipal dump following the closure of the mines. When it became a Superfund site<sup>5</sup>, it was commonly called the Baldwin Park Dump. In 1987, EPA started work on the area affected by the municipal dump. In 2002, EPA conducted a Superfund removal action on lead-contaminated soils in residential yards, most of which were located inside the city limits of Aurora.

The department started using federal Brownfield<sup>6</sup> funds for a redevelopment project on the southeast corner of the park in 2005 to address metals contamination. By reducing metals mobility and availability on site, a reduction in the amount of cadmium, lead and zinc coming from the site may also be achieved. This should help mitigate the contamination in Chat Creek. The project was completed in the fall of 2009. A report is forthcoming.

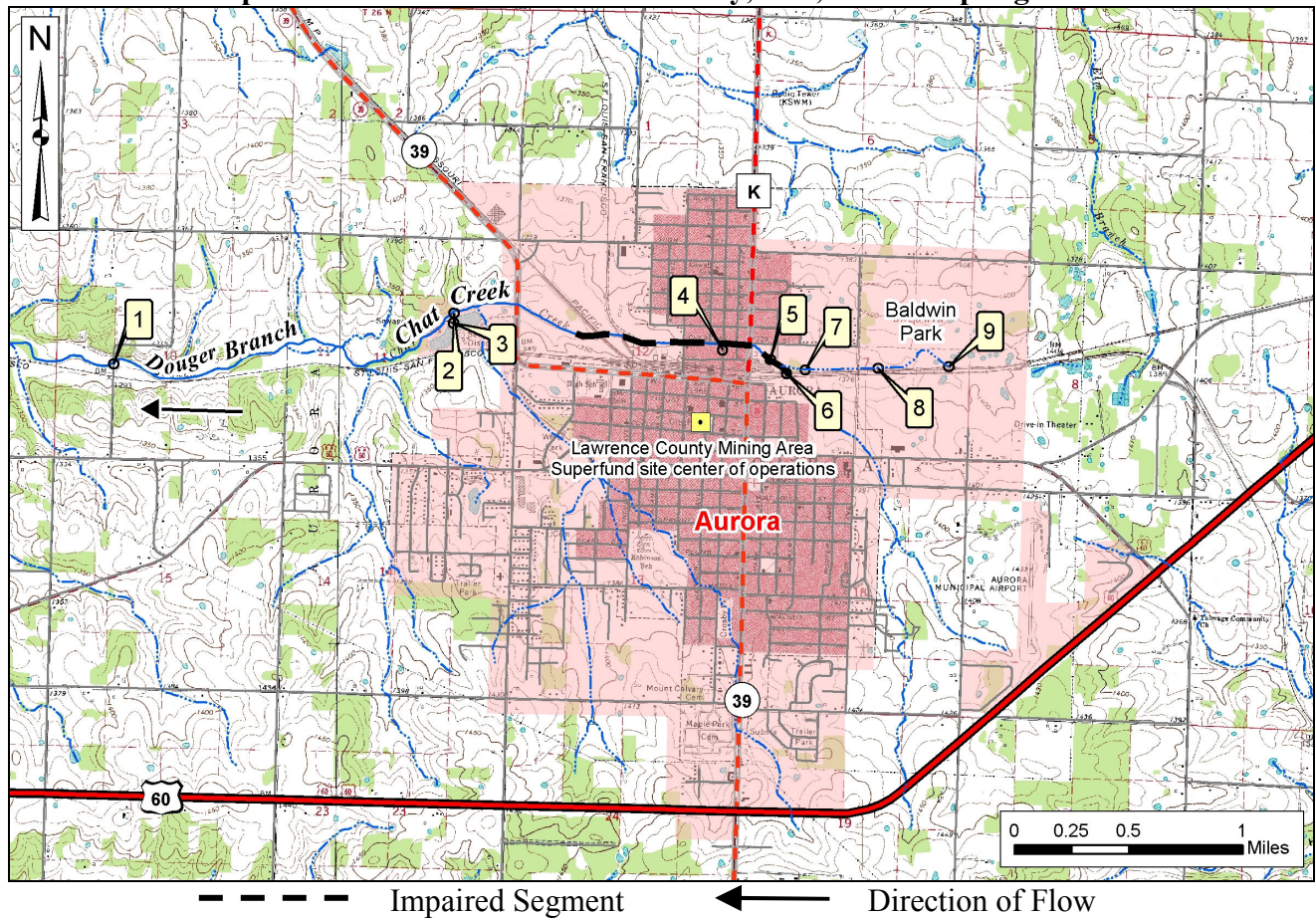
A map of Chat Creek showing the location of the sample sites is on the next page.

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<sup>5</sup> Superfund is the common name used to refer to the federal environmental program established to address abandoned hazardous waste sites. It is also the name of the fund established by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, or CERCLA.

<sup>6</sup> The term Brownfield refers to property that may be contaminated by hazardous waste, which would complicate the expansion, redevelopment, or reuse of that property. ("Small Business Liability Relief and Brownfields Revitalization Act" signed into law January 11, 2002)

**Map of Chat Creek in Lawrence County, Mo., with Sampling Sites**



**Site Index**

- 1 – Chat Creek at County Road 1165
- 2 – Chat Creek near Aurora WWTP
- 3 – Chat Creek at McNatt Street in Aurora
- 4 – Chat Creek just upstream of State Highway K
- 5 – Chat Creek at rail road tracks.
- 6 – Trib. to Chat Creek, 0.3 miles above State Highway 39.
- 7 – Trib. to Chat Creek, 0.6 miles above State Highway 39
- 8 – Trib. to Chat Creek, 0.76 miles above State Highway 39
- 9 – Trib. to Chat Creek, near Baldwin Park

**For more information call or write:**

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